

How Many Beer Bubbles?

(Author name withheld by request)

It comes as no surprise that beer is the most popular, most consumed alcoholic drink in the world. In 2019, approximately 50 billion gallons of beer were produced. By comparison, Lake Mead (no pun intended) at the Hoover Dam, contains roughly 326,000 gallons of water. The amount of beer produced in 2019 would make 154,000 Lake Meads.

Given the popularity of the drink, it makes sense that people might be curious about the science behind a glass of beer, specifically lager. So just how is the quantity of bubbles in a glass of lager is determined?

It's All About Math

It is surprisingly complex how the quantity of bubbles is determined. Without getting too technical, it all boils down to math. Carbonated beverages are carbonated because of the presence of dissolved carbon dioxide (CO_2). The quantity of bubbles will be decided according to the balance between dissolved CO_2 and gas-phase CO_2 . Scientists calculate what that balance will be by using complex equations, ultimately determined by Henry's law.

Henry's law is a chemistry rule dictating dissolved gas in liquid is relative to the partial pressure above it. The higher the pressure, the greater the carbonated effect from dissolved CO_2 in the liquid. In other words, the more pressure there is between the sealed cap of a bottle and the beer within, the more bubbles there will be when the seal is broken. Who knew gas could be so interesting?

It's All About Temperature

Temperature is also a critical factor in determining how many bubbles will be formed when a bottle of lager is opened. Once again, the process is technical and complex. The long and short of it is this: the colder the beer, the denser the partial pressure underneath the cap. The denser the partial pressure, the more effervescent the reaction once the cap is removed. Therefore, the colder the beer, the more bubbles there will be when the bottle is opened. Enjoying an ice-cold beer has new meaning.

It's All About Technique

Just about everyone has had the unfortunate experience of opening a bottle of beer only to have it overflow. That situation is the result of too many bubbles. Is there anything that can be done to minimize the number of bubbles produced as the dissolved CO_2 mixes with air? In a nutshell: yes, there is. Contained within the bottle is science. Outside the bottle is technique. Assuming the beer is intended to be poured into a glass, all one needs to do is tilt the glass so that the beer flows down the side. This technique slows down the liquid which in turn minimizes the number of bubbles and their rate of growth.

Conclusion

Enjoying a nice lager is one of life's simple pleasures. The number of bubbles present in a bottle or glass of lager may seem insignificant. In fact, the number of bubbles has a direct result on just how enjoyable

that experience will be. A host of complex math and science determines whether the next bottle of lager will be refreshing, or if it will fall flat (pun intended this time).ⁱ

Tags: science, math, lager, bubbles, ACS Omega, carbon dioxide

ⁱ The research was published in ACS Omega periodical.